ABSTRACT OF THE DISCLOSURE

Pretreatment removes oxygen from coal being fed to coal pyrolysis processes. The pretreatment improves the quality of the liquid produced. Free molecular oxygen present in the hot zone of the pyrolysis process causes the low molecular weight hydrocarbons that are evolved to polymerize rapidly into heavy, viscous, black tars that drastically reduce the value of the liquid product. A major source of free oxygen in a coal pyrolysis process is from the coal itself. Some oxygen in ~~run of the mine~~ commercial coal is present as adsorbed or loosely-bound molecular oxygen that can be removed by heating the coal to about 350°F (177°C) either under vacuum, or in a sweep gas in which the oxygen partial pressure is kept less than around 100 μm. It is the loosely-bound oxygen, not the tightly-bound oxygen present in the form of compounds such as cresols and phenols, that triggers chain reactions that convert the lower molecular weight (100 to 200) hydrocarbons into the high molecular weight (2000 to 5000) tars that are so viscous that their commercial value is about that of the lowest grade fuel oil. Tests carried out with small pyrolysis systems in a laboratory have demonstrated that the process can be carried out by heating the coal in a vacuum, but this introduces troublesome problems such as vacuum-air locks, air in-leakage, and strength requirements in vessel walls. These problems of vacuum systems can be avoided by using a sweep gas with a low content of oxygen such as nitrogen or cleaned and deoxygenated furnace stack gas. A batch of crushed coal can be

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treated in a static bed, or a steady-flow system with the bed fluidized by gas flow or by vibration can be employed to minimize the residence time required for the oxygen removal process. The coal residence time and process temperatures selected will depend on the type of coal and the system integration requirements. The hot treated coal can be fed directly to the pyrolysis process.